Homeworks

1) MATLAB routines for entropy *H(X)*, joint entropy *H(X,Y)*, Kullback-Leibler distance *D(p||q)* and mutual information *I(X,Y)* for an arbitrary vector or a set of arbitrary pairs (that is, the probability mass function is unknown).
2) Solve Problem 5 – seminar on Data Compression (Seminar 4) and implement the Sardinas-Patterson test for unique decodability.
3) Huffman codes (implementation).
4) Do the following:
    a. Compute π using a probabilistic method.
    b. Implement Monte-Carlo method for the univariate integral $\int_a^b f(x)\,dx$ (in MATLAB).
    c. Suggest ways to compute the integrals $\int_0^\infty e^{-x} f(x)\,dx$ and $\int_{-\infty}^\infty e^{-x^2} f(x)\,dx$ using Monte-Carlo method.
5)
    a. Prove Hadamard inequality.
    b. Compute differential entropy for the continuous distributions studied at Probability and Statistics Course using Maple and special functions.
6) Seminar 9, Problems 4 and 7.
7) Choose a variant of Lempel-Ziv algorithm and implement it.